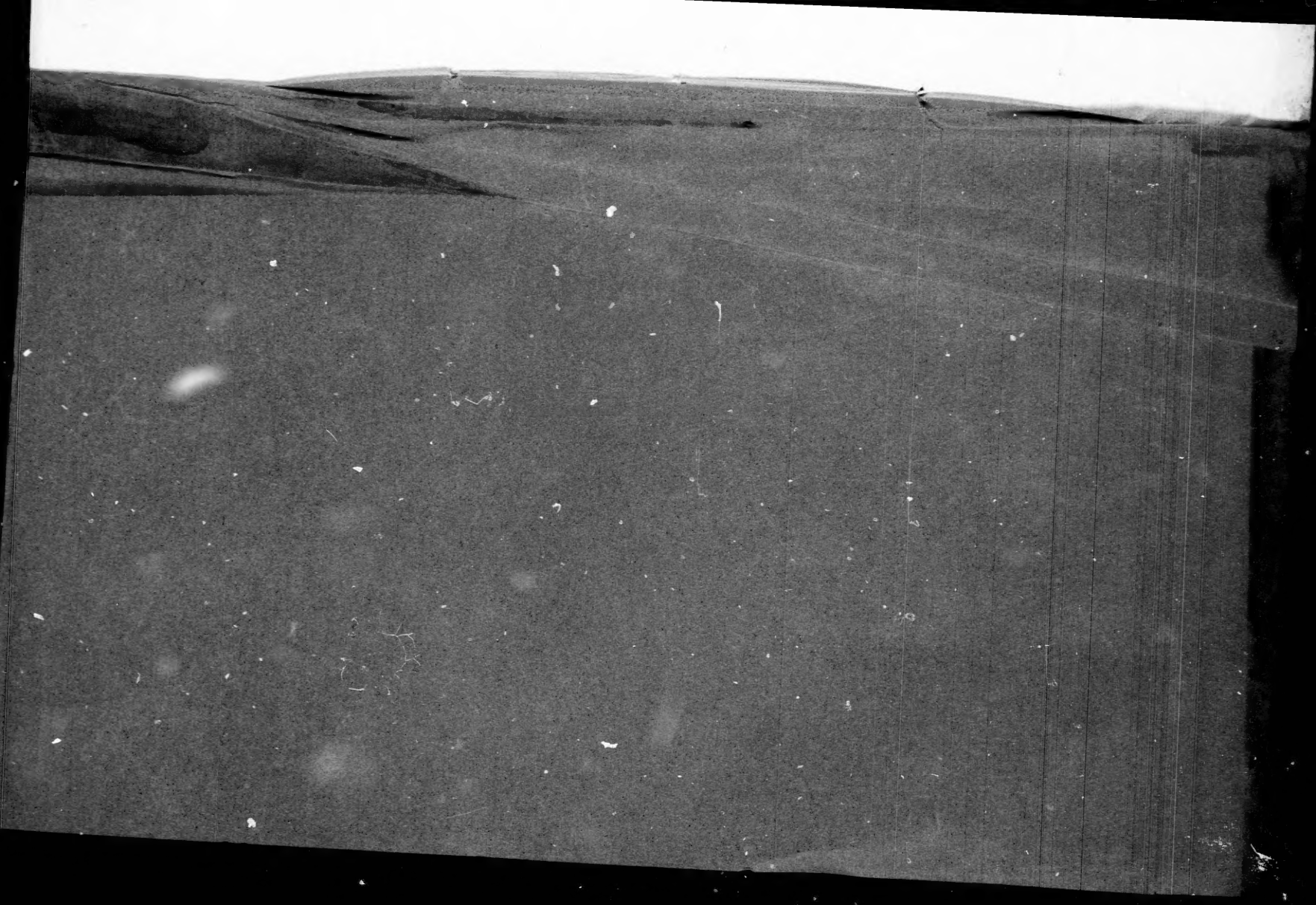

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ON

NEW SPECIMENS OF EOZOON.

BY

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SINCE the subject of Laurentian fossils was placed before this Society in the papers of Dr. Dawson, Dr. Carpenter, Dr. T. Sterry Hunt, and myself in 1865, additional specimens of *Eozoon* have been obtained during the explorations of the Geological Survey of Canada. These, as in the case of the specimens first discovered, have been submitted to the examination of Dr. Dawson; and it will be observed, from his remarks contained in the paper which is to follow, that one of them has afforded further, and what appears to him conclusive, evidence of their organic character. The specimens and remarks have been submitted to Dr. Carpenter, who coincides with Dr. Dawson; and the object of what I have to say in connexion with these new specimens is merely to point out the localities in which they have been procured.

The most important of these specimens was met with last summer by Mr. G. H. Vennor, one of the assistants on the Canadian Geological Survey, in the township of Tudor and county of Hastings, Canada West, about forty-five miles inland from the north shore of Lake Ontario, west of Kingston. It occurred on the surface of a layer, 3 inches thick, of dark-grey micaceous limestone or calc-schist, near the middle of a great zone of similar rock, which is interstratified with beds of yellowish-brown sandstone, grey close-grained siliceous limestone, white coarsely granular limestone, and bands of dark-bluish compact limestone and black pyritiferous slates, to the whole of which Mr. Vennor gives a thickness of 2000 feet. Above this zone are reddish granitic gneiss, and a great thickness of green diorite-slates; while beneath it are grey and pink dolomites, bluish and greyish mica-slates, grey siliceous whetstone-slate, with whitish brown-weathering dolomites, which often pass into coarse conglomerates, enclosing a multitude of large well-rounded masses of gneiss, syenite, and quartzite; to which succeed whitish highly crystalline limestone, dark-green chlorite-slates, with workable beds of magnetic iron-ore, and at the base red orthoclase felspathic rocks. This series, according to Mr. Vennor's section (which is appended), has a thickness of 2000 feet; but the possible occurrence of more numerous folds than have yet been detected may hereafter require a considerable reduction.

These measures appear to be arranged in the form of a trough, to the eastward of which, and probably beneath them, there are rocks resembling those of Grenville, from which the former differ considerably in lithological character; and it is therefore supposed that the Hastings series may be somewhat higher in horizon than that of

Grenville. From the village of Madoc, the zone of limestone which has been particularly alluded to runs to the eastward on one side of the trough, in a nearly vertical position into Elzivir, and on the other side to the northward, through the township of Madoc into that of Tudor, partially and unconformably overlain in several places by horizontal beds of Lower Silurian limestone, but gradually spreading, from a diminution of the dip, from a breadth of half a mile to one of four miles. Where it thus spreads out in Tudor it becomes suddenly interrupted for a considerable part of its breadth by an isolated mass of anorthosite rock, rising about 150 feet above the general plain, and supposed to belong to the unconformable Upper Laurentian, thus showing that the specimens of *Eozoon* of this neighbourhood, like those previously discovered and described, belong to the Lower Laurentian series.

The Tudor limestone is comparatively unaltered; and, in the specimen obtained from it, the general form or skeleton of the fossil (consisting of white carbonate of lime) is imbedded in the limestone without the presence of serpentine or other silicate, the colour of the skeleton contrasting strongly with that of the rock. It does not sink deep into the rock, the form having probably been loose and much abraded on what is now the under part, before being entombed. On what was the surface of the bed, the form presents a well-defined outline on one side; and in this and the arrangement of the septal layers it has a marked resemblance to the specimen first brought from the Calumet, eighty miles to the north-east, and figured in the 'Geology of Canada,' p. 49; while all the forms from the Calumet, like that from Tudor, are isolated, imbedded specimens, unconnected apparently with any continuous reef, such as exists at Grenville and the Petite Nation. It will be seen, from Dr. Dawson's paper, that the minute structure is present in the Tudor specimen, though somewhat obscure; but in respect to this, strong subsidiary evidence is derived from fragments of *Eozoon* detected by Dr. Dawson in a specimen collected by myself from the same zone of limestone near the village of Madoc, in which the canal-system, much more distinctly displayed, is filled with carbonate of lime, as quoted from Dr. Dawson by Dr. Carpenter in the Journal of this Society for August 1866.

In Dr. Dawson's paper mention is made of specimens from Wentworth, and others from Long Lake. In both of these localities the rock yielding them belongs to the Grenville seam, or uppermost of the three great bands of limestone heretofore described as interstratified in the Lower Laurentian series. That at Long Lake, situated about twenty-five miles north of Côte St. Pierre in the Petite-Nation Signiory, where the best of the previous specimens were obtained, is in the direct run of the limestone there; and like it the Long-Lake rock is of a serpentinous character. The locality in Wentworth occurs on Lake Louisa, about sixteen miles north of east from that of the first Grenville specimens, from which Côte St. Pierre is about the same distance north of west, the lines measuring these distances running across several important undulations in the Grenville band

in both directions. The Wentworth specimens are imbedded in a portion of the Grenville band, which appears to have escaped any great alteration, and is free from serpentine, though a mixture of serpentine with white crystalline limestone occurs in the band within a mile of the spot. From this grey limestone, which has somewhat the aspect of a conglomerate, specimens have been obtained resembling some of the figures given by Gümbel in his 'Illustrations' of the forms met with by him in the Laurentian rocks of Bavaria.

In decalcifying by means of a dilute acid some of the specimens from Côte St. Pierre, placed in his hands in 1864–1865, Dr. Carpenter found that the action of the acid was arrested at certain portions of the skeleton, presenting a yellowish-brown surface; and he showed me, two or three weeks ago, that in a specimen recently given him, from the same locality, considerable portions of the general form remained undissolved by such an acid. On partially reducing some of these portions to a powder, however, we immediately observed effervescence by the dilute acid; and strong acid produced it without bruising. There is little doubt that these portions of the skeleton are partially replaced by dolomite, as more recent fossils are often known to be, of which there is a noted instance in the Trenton limestone of Ottawa. But the circumstance is alluded to for the purpose of comparing these dolomitized portions of the skeleton with the specimens from Burgess, in which the replacement of the septal layers by dolomite appears to be the general condition. In such of these specimens as have been examined the minute structure seems to be wholly, or almost wholly, destroyed; but it is probable that upon a further investigation of the locality some spots will be found to yield specimens in which the calcareous skeleton still exists unreplaced by dolomite; and I may safely venture to predict that in such specimens the minute structure, in respect both to canals and tubuli, will be found as well preserved as in any of the specimens from Côte St. Pierre.

It was the general form on weathered surfaces, and its strong resemblance to *Stromatopora*, which first attracted my attention to *Eozoon*; and the persistence of it in two distinct minerals, pyroxene and loganite, emboldened me, in 1857, to place before the Meeting of the American Association for the Advancement of Science specimens of it as probably a Laurentian fossil. After that, the form was found preserved in a third mineral, serpentine; and in one of the previous specimens it was then observed to pass continuously through two of the minerals, pyroxene and serpentine. Now we have it imbedded in limestone, just as most fossils are. In every case, with the exception of the Burgess specimens, the general form is composed of carbonate of lime; and we have good grounds for supposing it was originally so in the Burgess specimens also. If, therefore, with such evidence, and without the minute structure, I was, upon a calculation of chances, disposed to look upon the form as organic in 1857, much more must I so regard it when the chances have been so much augmented by the subsequent accumulation of

evidence of the same kind, and the addition of the minute structure, as described by Dr. Dawson, whose observations have been confirmed and added to by the highest British authority upon the class of animals to which the form has been referred, leaves on my mind no room whatever for doubt of its organic character. Objections to it as an organism have been made by Professors King and Rowney; but these appear to me to be based upon the supposition that because some parts simulating organic structure are undoubtedly mere mineral arrangement, therefore all parts are mineral. Dr. Dawson has not proceeded upon the opposite supposition, that because some parts are, in his opinion, undoubtedly organic, therefore all parts simulating organic structure are organic; but he has carefully distinguished between the mineral and organic arrangements. I am aware, from having supplied him with a vast number of specimens prepared for the microscope by the lapidary of the Canadian Survey, from a series of rocks of Silurian and Huronian, as well as Laurentian age, and from having followed the course of his investigation as it proceeded, that nearly all the points of objection of Messrs. King and Rowney passed in review before him prior to his coming to the conclusions which he has published; and his reply to these objections forms a part of the succeeding paper.

APPENDIX.

Ascending Section of Laurentian Rocks in the County of Hastings, Canada West. By H. G. Vennor, Esq.

	feet.
1. Red felspathic strata, composed chiefly of red orthoclase, colourless quartz, and grey or greenish-grey hornblende, running in streaks in some places. The greater part of the mass is coarse-grained; but there occur in it occasional interstratified bands of a pale flesh-red, which are finer in grain; red hæmatite in streaks, and iron pyrites in crystals, are more or less scattered through the mass, which has a probable thickness considerably over	5000
2. Dark-green chlorite slates, associated with masses of greenstone and actinolite-rock, probably in lenticular patches, and interstratified with occasional beds of magnetic iron-ore, of which the Seymour bed, thirty feet thick, is one. Bands of pale flesh-red felsite, or petrosilex, are of occasional occurrence in the mass; and garnets characterize some parts of the chlorite slates.....	200
3. Whitish highly crystalline limestone, interstratified with three bands of tremolite, and with grey and pinkish dolomites, weathering drab or some shade of yellowish-grey, presenting beds of from fifteen to forty feet in thickness. Where the limestone adjoins the greenstone of No. 2, the limestone becomes charged with grains of quartz, and more or less interstratified with bands of quartz and siliceous or micaceous slates. When the dolomite and greenstone adjoin, the dolomite presents thin layers or segregated veins, composed of calcspar, bitter spar, and small crystals of hornblende, which are characterized occasionally by the occurrence of copper-pyrites, and, on the eighteenth lot of the fifth concession of Madoc, by the presence of gold in considerable quantity, the three-inch belt in which it is enclosed being flanked on each side by soapstone, of which there are occasional beds in the upper part of the mass, some of them four feet thick	2200
4 Grey siliceous or fine micaceous slates, fit for whetstones, with an interstratified mass of yellowish white dolomite, weathering yellowish	

brown, having a thickness of sixty feet, and separated into beds by thin layers of the mica-slates The dolomite beds often pass into conglomerates, enclosing a multitude of well-rounded masses of gneiss, syenite, and quartzite, ranging in diameter from one to twelve inches ..... feet. 400

5. Bluish and greyish mica-slates, studded in some places with crystals of magnetic oxide of iron, and interstratified with an occasional band of quartzite 500

6. Grey and pinkish dolomite, weathering brown 100

7. Grey micaceous limestone or calc-schist, interstratified with beds of yellowish-brown sandstone, grey impure limestone, white coarsely granular limestone, and bands of dark-bluish compact limestone and black pyritiferous slates. The calc-schist greatly predominates, and in Tudor it is cut by several N.W. & S.E. lodes, containing galena in considerable quantity, in a matrix of calc-spar and barytes. Near the middle of the mass, on the surface of a three-inch band of the calc-schist in Tudor, on the fifteenth lot of the Hastings road-range, east side, was obtained a fossil which Dr. Dawson, after careful examination, pronounces to be *Eozoon Canadense* 2000

8 Green diorite-slates, interstratified with beds of fibrous diorite holding iron-pyrites, and with bands of mica-schist; somewhat below the middle of the mass there occurs a six-feet band of white, highly crystalline limestone, in which is interstratified a bed of earthy graphite, with a thickness of a foot; and a three-feet bed of finely granular white iron-pyrites underlies the limestone. These diorite-slates graduate downwards into mica-slates, which are interstratified with frequent bands resembling serpentine, and some of green and reddish coarse soapstone, which has been used for furnace-hearths. These mica-slates graduate into green massive hornblende-rock or amphibolite, the weathered surface of which in some places shows subradiating forms of hornblende. The amphibolite finally passes into diorite-slates, composed of the same green hornblende, with a large admixture of albite. These four groups of rock occupy a breadth of 15,000 feet, standing in a vertical attitude on the east side of Elzivir; and as there is reason to suppose that they fold over sharply on themselves, their volume is estimated at 7500

9. Reddish granitic gneiss, the total thickness of which has not been ascertained, but is for the present estimated at 2100

20,000